

PIPING PLOVER (*Charadrius melodus*) MONITORING AT
CAPE LOOKOUT NATIONAL SEASHORE

2015 SUMMARY REPORT



Green Flag (6XA) was re-sighted at Cape Lookout National Seashore, September 15, 2015. NPS 2015.

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Abstract

A total of 43 pairs of piping plovers were recorded at Cape Lookout National Seashore (CALO) in 2015. The birds at CALO accounted for 67% of the nesting pairs in North Carolina. Thirty four pairs nested on North Core Banks and nine pairs on South Core Banks. Egg-laying was initiated on April 15th and a total of 56 nests were documented. Thirty two nests hatched and 34 chicks fledged. Productivity was 0.79 chicks fledged per nesting pair. Two broods foraged on the oceanside in 2015.

Introduction

The piping plover is listed as a federal threatened species by the U.S. Fish and Wildlife Service (1985). Piping plover monitoring at CALO began with a baseline study in 1989 (Fraser *et al*, 1990). The park is a significant nesting area, containing 67% of the nesting pairs in the state of North Carolina (Schweitzer, 2015). CALO also serves as a wintering and migratory site. There are three designated wintering critical habitat units within the seashore. Monitoring focuses on documenting reproductive success, implementing methods to increase the productivity of this threatened species, and non-breeding use surveys. This report contains a summary of monitoring results for 2015, comparisons to results from previous years, and discussions based on long-term monitoring of piping plovers at CALO.

Site Description

Cape Lookout National Seashore is located in the southern Outer Banks of North Carolina between Ocracoke and Beaufort Inlets. The seashore was divided into four barrier islands at the beginning on the 2015 breeding season. The northernmost island, North Core Banks (NCB), was 18 miles long, extending from Ocracoke Inlet to Old Drum Inlet. Middle Core Banks (MCB) extended from Old Drum Inlet to Ophelia Inlet at four miles in length. During the 2015 breeding season Old Drum Inlet closed. The MCB section remained closed to ORVs for the duration of the breeding season. For reporting purposes MCB is treated as part of NCB, representing breeding pairs from Ocracoke Inlet to Ophelia Inlet, mile 0 to mile 22.7. South Core Banks (SCB) extends southward from Ophelia Inlet almost 24 miles to Barden Inlet. The Core Banks have a northeast to southwest orientation and exhibit a low profile landscape. Shackleford Banks (SB), is 9 miles long and has an east-west orientation with a higher dune system and larger areas of vegetation. All islands in the park are subject to constant and dramatic change by the actions of wind and waves.

Methods

Bird sanctuary signs were used to close all known piping plover nesting habitat to pedestrian and vehicular entry by April 1. Beginning in early April, nesting areas were surveyed daily for territorial pairs and nests. Potential habitat outside posted areas was monitored and posted as necessary with a minimum 150 foot buffer distance from nest scrapes and nests. Locations of nests were recorded and monitored daily until they hatched or were lost. The Interim Protected Species Management Plan/ Environmental Assessment (IPSMP), March 2006, developed for CALO provides guidance for monitoring and management (National Park Service 2006).

Nests were protected with predator exclosures if the topography of the location was suitable and monitoring was sufficient. Exclosures were circular, 10 feet in diameter, made of 4"x 2" mesh wire fence anchored with steel rebar and were topped with 3/4" mesh bird netting. Use of predator exclosures and monitoring adhered to Piping Plover (*Charadrius melodus*) Atlantic Coast Population Revised Recovery Plan, Appendix F (USFWS, 1996).

After nests hatched, broods were monitored daily until the chicks fledged or were lost. Ocean beach foraging areas were closed to vehicle traffic while the chicks were present.

Counts of wintering and migrating piping plovers were made monthly from August to March. The counts were made near the 15th of each month in the non-nesting season. The ocean beach, inlets and soundside sandy beaches were surveyed. Banded birds were searched for on the 5th, 15th, and 25th of the month during the fall migration.

Results

Nesting Pairs

A total of 43 pairs of piping plovers attempted nesting at CALO in 2015, Table 1. Table 2 includes 2015 pair numbers and data back to 1989. Thirty four pairs nested on North Core Banks (NCB), and nine pairs on South Core Banks (SCB). Birds nested in six distinct areas (Figure 1). Appendix 1 shows the results of the June census window pair count. The four mile area around Ophelia Inlet contained the highest number of nesting pairs.

Table 1. Number of Pairs by Occupied Nesting Areas in 2015.

| ISLAND | NESTING AREA | NUMBER OF PAIRS |
|------------------|----------------------|-----------------|
| North Core Banks | Portsmouth Flats | 14 |
| North Core Banks | Old Drum Inlet | 6 |
| North Core Banks | New Drum Inlet | 10 |
| North Core Banks | Ophelia Island | 4 |
| South Core Banks | Plover/Ophelia Inlet | 8 |
| South Core Banks | Power Squadron Spit | 1 |

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2015

| | 1989 | 1992 | 1993 | 1994 | 1995 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ocracoke Inlet | 0 | 2 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Portsmouth Flats | 14 | 8 | 9 | 7 | 8 | 17 | 15 | 9 | 11 | 9 | 8 | 6 | 4 | 6 | 8 | 14 | 14 | 12 | 13 | 12 | 19 | 13 | 14 | 14 |
| Kathryn-Jane Flats | 7 | 11 | 9 | 12 | 11 | 10 | 8 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Old Drum Inlet | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 6 | 8 | 8 | 4 | 6 | 6 |
| New Drum Inlet (NCB/MCB) Mile 21 to 22.29 | 4 | 5 | 9 | 10 | 6 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 6 | 5 | 8 | 8 | 10 | 12 | 13 | 10 |
| New Drum Inlet (SCB)/ Ophelia Island Mile 22.3 to 23 | 3 | 3 | 4 | 5 | 4 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 5 | 5 | 3 | 4 |
| Plover Inlet/ Ophelia Inlet Mile 23 to 24 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 8 | 15 | 17 | 18 | 11 | 11 | 8 | 8 | 11 | 11 | 8 |
| Cape Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 2 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 |
| Power Squadron Spit | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| Shackleford Banks | | | | | | | | | | | | | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CALO Total | 34 | 33 | 35 | 39 | 35 | 36 | 32 | 21 | 16 | 16 | 15 | 14 | 13 | 27 | 33 | 45 | 46 | 37 | 43 | 41 | 51 | 45 | 47 | 43 |

Nests

There were 56 nesting attempts made in 2015 (Appendix 2). The earliest nest initiation was on April 15th and the latest was on June 17th. Forty-five nests were on NCB and eleven were on SCB. Of the 56 nests, 13 were re-nests. Thirty two nests hatched and 34 chicks fledged from 19 different broods. The average clutch size was 3.73 eggs and 105 of 209 known eggs hatched. Productivity for CALO was 0.79 chicks fledged per nesting pair (Table 3 & Appendix 3). Refer to Figures 2-5 for detailed maps of nests and nesting sites, (2014 DOQQ base layers).

Table 3. Piping Plover Nesting Success at CALO 2000-2015

| Year | # Nests | # Pairs | # Eggs | Nests Hatched | | Eggs Hatched | | Chicks Fledged | | Fledge Rate (Chicks/pair) |
|------|---------|---------|--------|---------------|-----|--------------|-----|----------------|-----|---------------------------|
| | | | | # | % | # | % | # | % | |
| 2000 | 18 | 16 | 65 | 12 | 67% | 43 | 66% | 8 | 19% | 0.5 |
| 2001 | 19 | 16 | 64 | 8 | 42% | 24 | 38% | 5 | 21% | 0.31 |
| 2002 | 20 | 15 | 65 | 13 | 65% | 43 | 66% | 4 | 9% | 0.27 |
| 2003 | 15 | 14 | 55 | 7 | 47% | 23 | 42% | 6 | 26% | 0.43 |
| 2004 | 13 | 13 | 44 | 11 | 85% | 37 | 84% | 12 | 32% | 0.92 |
| 2005 | 31 | 27 | 105 | 24 | 77% | 69 | 66% | 23 | 33% | 0.85 |
| 2006 | 37 | 33 | 125 | 29 | 78% | 87 | 70% | 29 | 33% | 0.88 |
| 2007 | 58 | 45 | 173 | 29 | 50% | 79 | 46% | 11 | 14% | 0.24 |
| 2008 | 57 | 46 | 179 | 31 | 54% | 88 | 49% | 9 | 10% | 0.20 |
| 2009 | 45 | 36 | 145 | 24 | 53% | 83 | 57% | 30 | 36% | 0.83 |
| 2010 | 58 | 43 | 204 | 34 | 59% | 98 | 48% | 31 | 32% | 0.72 |
| 2011 | 48 | 41 | 157 | 35 | 73% | 102 | 65% | 37 | 36% | 0.90 |
| 2012 | 66 | 51 | 207 | 36 | 54% | 98 | 47% | 29 | 30% | 0.57 |
| 2013 | 52 | 45 | 173 | 30 | 58% | 97 | 56% | 47 | 48% | 1.04 |
| 2014 | 57 | 47 | 190 | 28 | 49% | 88 | 46% | 9 | 10% | 0.19 |
| 2015 | 56 | 43 | 209 | 32 | 57% | 105 | 50% | 34 | 32% | 0.79 |

Predator Exclosures

In 2015, predator exclosures were used to protect 28 (50%) nests. Of the nests with exclosures 22 (78%) hatched. Six nests with predator exclosures didn't hatch. Three were abandoned, two were lost to unknown reasons and one was lost to weather (flooding/storm). Predator exclosures were not used on 28 (50%) nests due mainly to the inaccessibility of MCB, to birds nesting in vegetation and three nesting pairs non-acceptance. Of the nests without exclosures 10 hatched (36%). Eighteen nests didn't hatch; eleven were lost to unknown reasons, four to ghost crabs (*Ocyrode quadrata*), two

nests were lost to unknown predation and one nest was lost to raccoon. Table 4 shows likely causes of nest losses for all nests. The predator column includes four ghost crabs losses, two unknown predator losses and one raccoon loss. There were no observations of raccoons circling or digging at predator enclosures on SCB or NCB.

Table 4. Likely Causes of Piping Plover Nest Losses in 2015.

| NESTING AREA | # NESTS | # LOST | PREDATORS | STORM | ABANDONED | UNKNOWN |
|--------------------------|---------|--------|-----------|-------|-----------|---------|
| Portsmouth Flats | 18 | 8 | 4 | 0 | 0 | 4 |
| Old Drum Inlet (NCB) | 7 | 1 | 0 | 0 | 0 | 1 |
| New Drum Inlet (NCB) | 16 | 8 | 3 | 0 | 0 | 5 |
| Ophelia Island (NCB) | 4 | 0 | 0 | 0 | 0 | 0 |
| Plover Inlet (Mile 23.6) | 10 | 6 | 0 | 1 | 2 | 3 |
| Power Squadron Spit | 1 | 1 | 0 | 0 | 1 | 0 |
| Total | 56 | 24 | 7 | 1 | 3 | 13 |

Beach Closures and Brood Foraging

The area between Ophelia Inlet and Ramp 24 (Figure 5), 1 mile in length, was completely closed to vehicles (except for NPS monitors) for piping plover chicks from May 14th to July 15th. A second ocean beach closure to vehicles was posted at Portsmouth Flats from mile 1.6 to mile 1.4, from May 29th to June 26th for one brood that foraged on the ocean beach. The closures began the day of hatch of the first nest at Ophelia Inlet (SCB) or when chicks were present on the ocean beach and remained in place until the last chick was fledged, confirmed lost, or moved out of area. The middle core banks section was closed to motor vehicle use from April 1st until NCB nest 33 brood fledged on August 4th.

Two broods foraged on the ocean beach in 2015. One brood (NCB nest 7) foraged on both the oceanside and pond area of Portsmouth Flats. The second brood (NCB nest 33) hatched and foraged on a narrow beach segment at Old Drum Inlet. All other chicks foraged on soundside beach, sand flats, mudflats and ephemeral pools in areas closed to vehicles and in most cases all entry.

Non-breeding Piping Plover Surveys

Surveys in 2015 covered the entire seashore from January to December with the exception of the three mile Middle Core Banks section. Old Drum Inlet slowly closed during the 2015 breeding season, but reopened when Hurricane Joaquin passed in October making access and monitoring difficult. MCB was censused during fall migration in August and September. Table 5 below list this year's counts. Appendix 4 lists non-breeding counts from 2007-2015.

Table 5. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2015.

| | January | February | March | August | September | October | November | December |
|--------------|-----------|-----------|-----------|------------|-----------|-----------|-----------|-----------|
| NCB | 2 | na | ? | 95* | 42* | 17 | 0 | 5* |
| SCB | 9 | na | 21 | 15 | 20 | 3 | 4 | 18 |
| SB | 4 | na | 19 | 15 | 8 | 14 | 8 | 2 |
| Total | 15 | na | 40 | 125 | 70 | 34 | 12 | 25 |

*Includes MCB

Banded Piping Plovers

Fifty three observations of 34 individual non-breeding banded birds were made in the park in 2015, Appendix 5. Birds were re-sighted during migration and over wintering from the Great Lakes, Great Plains and Atlantic Coast populations; and banded from Michigan, Massachusetts, New York, Georgia, North Dakota, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, and Ontario. One banded female (-, W:-, YL) nested in the seashore at Portsmouth Flats on NCB, nest 3. This bird was banded as a wintering adult in the Bahamas. This is the fourth year that she has nested in the seashore. This female fledged two chicks that were banded Gf (A5P) and Gf (XK2) by Virginia Tech research staff. In total Virginia Tech research staff banded 9 breeding adults and 7 chicks at the Portsmouth Flats nesting site in 2015.

Discussion

Nesting Habitat

The habitat at New Drum Flats and Old Drum Flats/Inlet continues to provide excellent nesting and foraging opportunities in the breeding season. This high quality nesting habitat from Old Drum to Plover Inlet contained 65% (28 pairs) of the nesting pairs in 2015. Portsmouth Flats, another important area, continued to provide nesting habitat on NCB for 14 pairs (32%). Power Squadron Spit habitat supported one nesting pair in 2015. The north tip of NCB at Ocracoke Inlet continues to erode and there was little nesting habitat available. There was no breeding activity documented in 2015. The habitat at Kathryn-Jane flats and Cape Point did not attract and hold nesting pairs in 2015.

CALO participated in the United States Geological Survey (USGS) “IPlover” nest habitat data collection and sea level rise model study for the second year. The study seeks to forecast the impact of sea level rise on piping plover nesting habitat. All 56 nests and 37 random points were uploaded into the database by using the mobile “IPlover” application on smartphones. Results of this study are not yet available.

Pair Numbers

The number of breeding pairs in the seashore decreased from 47 in 2014 to 43 in 2015. This may be the result of the low productivity in 2014. There is a long term 26-year trend of increasing pairs at CALO (Appendix 3), ranging from a low of 13 pairs in 2004 to a high of 51 pairs in 2012. Since 2006 with the implementation of the IPSMP the average number of pairs has been 43 pairs with a range of 51 to 36 pairs.

Nest Success

2015 brought moderate hatch success for piping plover nests in the park, 57% of the nests and 50% of the eggs hatched successfully. The seven predator related nest losses accounted for 29% of total losses. Ghost crab predation took four nests, two were lost to unknown predators and one was lost to raccoon predation. Three (12%) nests were abandoned. Thirteen (54%) nests losses were recorded as unknown and was the highest on record since implementation of the IPSMP. The unknown nest losses in 2014, 2013, 2012, 2011, 2010, 2009, 2008, and 2007 respectively were 10, 12, 11, 1, 3, 5, 7, and 3. This unknown nest loss rate reflects the reduced monitoring ability due to difficult access on MCB from 2015 to 2012 and due to reduced monitoring staff in 2015.

Predator exclosures have generally been effective in increasing hatch success. From 1997-2015, 70% of the nests protected with exclosures hatched, compared with a 41% hatch rate of the nests left unprotected

In 2015, predator exclosures use was up to 28 nests (50%) and greater than previous years. Only 17 nests or 30% of nests received predator exclosures in 2014. There was an effort to increase predator exclosure use on MCB this year. Use was up from 7 in 2013 and 0 in 2014 to 10 in 2015. Hatch success was up to 63% from 46% in 2014 and 48% in 2013. Predator exclosures were not used on all MCB nests due to uncertainty of monitoring ability.

Fledging Success

The fledging success for piping plovers at CALO was 0.79 chicks fledged per nesting pair in 2015 (Appendix 3, Chart 2). The actual number of chicks fledged was 34 fledglings. The productivity this year was above the long term average. The average fledge rate from 2000-2015 is 0.60 chicks per breeding pair (Table 3).

The Old Drum Inlet site had the highest fledge success in the seashore. There were six nesting pairs that produced 11 fledglings for a productivity of 1.83. New Drum flats with 10 pairs that produced 10 fledglings and a fledge success of 1.0 was the second highest site for productivity. Site by site reproductive successes for 2015 can be compared in Table 6.

Table 6. Differences in Reproductive Success between Major Nesting Areas in 2015.

| Nesting Area | Hatch Success | Fledge Success |
|----------------------|----------------------|-----------------------|
| Portsmouth Flats | 56% | 0.57 chicks per pair |
| Old Drum Flats/Inlet | 86% | 1.83 chicks per pair |
| New Drum Flats | 44% | 1.00 chicks per pair |
| Ophelia Island | 100% | 0.50 chicks per pair |
| Plover Inlet | 50% | 0.37 chicks per pair |

Predators

There were documented coyote (*Canis latrans*) tracks on SCB in the Cape Point and Power Squadron Spit area in the summer. This may partial explain the lack of piping plover productivity at these sites. Nest 10 at Power Squadron Spit had coyote tracks at and around the predator exclosure. The nest was abandoned at the expected hatch time. Coyote predation events were recorded at other shorebird nests on SCB. Documented raccoon and feral cat (*Felis catus*) tracks at nest sites continue to be a concern. One nest was taken by raccoon. In 2015 no attempts were made to dig into predator exclosures by raccoons or other mammals. Numerous river otter (*Lontra canadensis*) tracks were documented at the Ophelia and New Drum Flats nesting areas. River otter predation was documented in 2014, but not in 2015.

Human Disturbance

Posted closures for bird nesting areas were not always respected by park visitors. Law enforcement rangers issued zero citations for pedestrians in bird nesting areas and two citations for vehicles in wildlife closure in 2015.

Dogs were also a potential source of disturbance to nesting birds. Resource management staff did not specifically study dogs off leash in 2015, but from 2007 to 2013 79% of dogs were leashed and 21% of dogs were unleashed. Law enforcement rangers issued 2 dog off leash citations, 1 dog harassing wildlife citation, and 6 recorded verbal warnings on the core banks in 2015.

Non-nesting piping plovers

CALO continues to be an important migration stopover location and wintering site for piping plovers. Figure 7 illustrates non-breeding piping plover observations and critical habitat units. In 2015, 392 birds were recorded during 140 observations of piping plovers in the seashore during the non-nesting season. The area on NCB near Ocracoke Inlet again had high numbers of birds in spring and fall migrations. The area from Old Drum Inlet flats to Ophelia Inlet also had high numbers of birds counted in August and September. On NCB, 95 piping plovers were counted on the August 15th count and 42 on the September 15th count. Only 49 banded birds (12%) of the 392 non-breeding birds were recorded. There were 34 banded individuals identified. Seven banded piping plovers from the endangered Great Lakes population were re-sighted. Six banded piping plovers from the Eastern Canada study were re-sighted. In addition four birds were banded at Cape Hatteras and four banded at Cape Lookout National Seashores, North Carolina. Two birds were originally banded in the Bahamas. Nine birds from the Northeast including three from New Jersey, two from Massachusetts, two from New York, one from Rhode Island, and one from Maryland were re-sighted in 2015.

US Fish and Wildlife Service (USFWS) Biological Opinion and Recovery Goals

The USFWS provided CALO a biological opinion that included four performance measures for the Interim Protected Species Management Plan; 1) 25 or more pairs, 2) at least one nest per breeding pair, 3) a productivity rate of 0.75 or greater, and 4) at least once monthly winter plover surveys. Forty three breeding pairs were found in CALO in 2015 surpassing the target of 25 or more pairs of performance measure one. Forty three pairs produced 56 nests (1.3 nest per pair) surpassing the target of at least one nest per breeding pair of performance measure two. The 43 nesting pairs produced 34 fledglings for a fledge rate of 0.79, above the target of 0.75 of performance measure three. The fledge rate was below the 1996 USFWS recovery plan goal of 1.50 (USFWS 1996). Winter plover surveys at CALO were conducted at least once monthly from August until March (except February) to meet performance measure four. CALO is part of the Atlantic Coast southern recovery unit of North Carolina, Virginia, Maryland, and Delaware as defined by the USFWS recovery plan. The goal of the southern recovery unit is to increase and maintain for five years a total of 400 pairs. The southern recovery unit has not yet reached 400 pairs.

Conclusion

In 2015, piping plovers on Cape Lookout National Seashore continued their use of the habitat for breeding, migration, and wintering throughout the year. Nest success continues to be adequate, in part due to the predator exclosure program, but fledgling success is lower than the recovery goal. Although 105 eggs hatched only 34 chicks survived to fledging. The area from Ophelia Inlet to Old Drum Inlet and Portsmouth Flats contained the majority of breeding activity. The long term trends for pair numbers and productivity are trending upward.

Management Recommendations

- 1) Continue banding effort with Virginia Tech research staff on North Core Banks in order to understand movements and improve breeding pair monitoring.
- 2) Participate in Atlantic Coast Predator Exclosure study in 2016.
- 3) Continue participation in USGS “IPlover” habitat and climate change study.
- 4) Increase enforcement of dog on leash law throughout the year to minimize disturbance to piping plovers that are present year round.
- 5) Increase qualified monitoring staff to six monitors to ensure IPSMP daily monitoring requirements are met.

Literature Cited

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Appendix 1- 2015 PIPING PLOVER WINDOW CENSUS

2015 Piping Plover breeding census results: June 1-9

North Core Banks: 30 pairs, 4 singles

Ocracoke Inlet 0

Portsmouth Flats 10 pairs, 2 singles

Old Drum Inlet 5 pairs, 2 singles

New Drum Inlet 11 pairs

Ophelia Island 4 pairs

South Core Banks: 8 pairs

Plover Inlet 7 pairs

Cape Point 0

Power Squadron Spit 1 pair

Shackleford Banks: 0 piping plovers

Cape Lookout National Seashore: 38 pairs, 4 single birds

Appendix 2- 2015 PIPING PLOVER NEST DATA

NORTH CORE BANKS 2015

| Nest # | Pair # | MILE | DATE FOUND | CLUTCH SIZE | EXCLOSURE | HATCH DATE | EGGS HATCHED | # FLEDGED | COMMENTS (abbreviated) |
|--------|--------|-------|------------|-------------|-----------|------------|--------------|-----------|---|
| 1 | 01 | 22.73 | 17-Apr | 4 | 5-May | 17-May | 3 | 1 | Fledged 1 chick. Day 32 fledgling. |
| 2 | 02 | 22.10 | 17-Apr | 4 | 22-Apr | 21-May | 4 | 1 | Fledged 1 chick, last seen day 28. |
| 3 | 03 | 2.45 | 17-Apr | 4 | 28-Apr | 24-May | 2 | 2 | Fledged 2 chicks, last seen day 30; female (-, W:-, YL);chicks: GF(A5P) & GF(XK2) |
| 4 | 04 | 19.07 | 21-Apr | 4 | 22-Apr | N/A | 0 | 0 | Nest failed 5/12 (0 eggs), cause unknown. |
| 5 | 05 | 22.25 | 22-Apr | 4 | none | 21-May | 4 | 3 | Fledged 3 chicks, last seen day 28. |
| 6 | 06 | 22.21 | 22-Apr | 4 | none | 24-May | 3 | 1 | Fledged 1 chick, last seen day 33. |
| 7 | 07 | 1.58 | 23-Apr | 4 | 6-May | 31-May | 3 | 1 | Fledged 1 chick, foraged on ocean beach. Day 26 fledgling; Adults: GF(840) & GF(392) |
| 8 | 08 | 3.51 | 24-Apr | 4 | none | N/A | 0 | 0 | Nest failed 5/6, ghost crab predation. |
| 9 | 09 | 19.02 | 25-Apr | 4 | 12-May | 21-May | 4 | 4 | Fledged 4 chicks, last seen day 32. |
| 10 | 10 | 2.10 | 25-Apr | 4 | none | N/A | 0 | 0 | Nest failed 5/6, ghost crab predation. |
| 11 | 11 | 21.76 | 25-Apr | 4 | none | N/A | 0 | 0 | Nest failed 5/4 (0 eggs), cause unknown. |
| 12 | 12 | 22.68 | 25-Apr | 4 | none | 28-May | 4 | 1 | Fledged 1 chick, last seen day 29. |
| 13 | 13 | 3.17 | 26-Apr | 3 | none | N/A | 0 | 0 | Nest failed 5/6, ghost crab predation. |
| 14 | 14 | 19.35 | 27-Apr | 2 | none | 28-May | 2 | 1 | Fledged 1 chick, last seen day 25. |
| 15 | 15 | 22.19 | 27-Apr | 4 | none | N/A | 0 | 0 | Nest failed 5/2, unknown predation (yoke in nest cup). |
| 16 | 16 | 22.60 | 27-Apr | 4 | 5-May | 12-May | 4 | 0 | Brood failed 6/4, cause unknown. |
| 17 | 17 | 22.02 | 30-Apr | 4 | none | N/A | 0 | 0 | Nest failed 5/4, unknown predator (yoke in nest cup). |
| 18 | 18 | 22.20 | 5-May | 4 | none | 18-May | 4 | 1 | Fledged 1 chick, last seen day 31. |
| 19 | 19 | 1.79 | 13-May | 4 | none | N/A | 0 | 0 | Nest failed 6/1 (0 eggs), cause unknown; Adult:Gf(469) |
| 20 | 20 | 21.55 | 15-May | 4 | none | 21-May | 4 | 2 | Fledged 2 chicks, last seen day 30. |
| 21 | 21 | 2.15 | 15-May | 4 | 22-May | 16-Jun | 4 | 3 | Fledged 3 chicks, last seen day 25; Adult: GF(3E8) & GF(8C5); Chicks: GF(6U9) & GF(K27) |
| 22 | 22 | 22.24 | 15-May | 4 | none | N/A | 0 | 0 | Nest failed 6/2, raccoon predation. |
| 23 | 23 | 21.90 | 16-May | 3 | none | N/A | 0 | 0 | Nest failed 5/25 (0 eggs), cause unknown. |
| 24 | 24 | 21.75 | 16-May | 4 | none | N/A | 0 | 0 | Nest failed 6/8 (0 eggs), cause unknown. |

| | | | | | | | | | |
|----|----|-------|--------|---|--------|--------|---|---|--|
| 25 | 25 | 18.94 | 17-May | 4 | 23-May | 18-Jun | 3 | 3 | Fledged 3 chicks, last seen day 25. |
| 26 | 26 | 19.08 | 18-May | 4 | 23-May | 16-Jun | 3 | 0 | Brood failed 6/22, cause unknown. |
| 27 | 27 | 2.26 | 18-May | 4 | none | N/A | 0 | 0 | Nest failed 5/22, ghost crab predation. |
| 28 | 28 | 3.10 | 20-May | 4 | 30-May | 21-Jun | 4 | 0 | Brood failed 6/28, cause unknown; Adult: GF(6XA); Chick: GF(VLC) |
| 29 | 10 | 2.41 | 22-May | 2 | 11-Jun | 23-Jun | 2 | 0 | Brood failed 6/30, cause unknown; Chicks: GF(4H2) & GF(X4M) |
| 30 | 29 | 2.45 | 26-May | 4 | 5-Jun | 23-Jun | 1 | 0 | Brood failed 7/17, cause unknown. |
| 31 | 30 | 19.00 | 28-May | 4 | none | 28-May | 4 | 2 | Fledged 2 chicks, last seen day 25. |
| 32 | 11 | 21.75 | 28-May | 4 | 4-Jun | N/A | 0 | 0 | Nest failed 6/20 (0 eggs), cause unknown. |
| 33 | 31 | 18.48 | 28-May | 4 | 2-Jun | 25-Jun | 4 | 1 | Fledged 1 chick. Strong flight on day 40. |
| 34 | 32 | 2.39 | 29-May | 3 | none | N/A | 0 | 0 | Nest failed 6/11 (0 eggs), cause unknown. |
| 35 | 8 | 3.22 | 1-Jun | 4 | none | N/A | 0 | 0 | Nest failed 6/5 (0 eggs), cause unknown. |
| 36 | 23 | 21.90 | 2-Jun | 3 | none | N/A | 0 | 0 | Nest failed 6/8 (0 eggs), cause unknown. |
| 37 | 33 | 22.57 | 4-Jun | 4 | none | 2-Jul | 3 | 0 | Brood failed 7/19, cause unknown. |
| 38 | 19 | 2.10 | 10-Jun | 4 | 16-Jun | 7-Jul | 3 | 0 | Brood failed 7/10, cause unknown. |
| 39 | 34 | 2.44 | 10-Jun | 4 | none | 24-Jun | 4 | 2 | Fledged 2 chicks, last seen day 27. |
| 40 | 13 | 3.18 | 17-Jun | 4 | 24-Jun | 11-Jul | 3 | 0 | Brood failed 7/13, cause unknown; Adult: GF(39J) |
| 41 | 35 | 1.26 | 17-Jun | 3 | none | N/A | 0 | 0 | Nest failed 6/19 (0 eggs), cause unknown. |
| 42 | 36 | 3.21 | 17-Jun | 4 | 19-Jun | 10-Jul | 3 | 0 | Brood failed 7/17, cause unknown; Adults GF(5MP) GF(C15) |
| 43 | 22 | 22.00 | 18-Jun | 3 | 22-Jun | 11-Jul | 2 | 1 | Fledged 1 chick, last seen day 25. |
| 44 | 24 | 21.83 | 18-Jun | 2 | none | 10-Jul | 2 | 1 | Fledged 1 chick, last seen day 26. |
| 45 | 23 | 21.93 | 18-Jun | 3 | none | N/A | 0 | 0 | Nest failed 7/14 (0 eggs), cause unknown. |

34 nesting pairs, 45 nests, 27 hatched nests, 31 chicks fledged

SOUTH CORE BANKS 2015

| Nest # | Pair # | MILE | DATE FOUND | CLUTCH SIZE | EXCLOSURE | HATCH DATE | EGGS HATCHED | # FLEDGED | COMMENTS (abbreviated) |
|--------|--------|-------|------------|-------------|-----------|------------|--------------|-----------|--|
| 1 | 1 | 23.8 | 20-Apr | 4 | 22-Apr | 21-May | 4 | 0 | Brood failed by 5/26, cause unknown. |
| 2 | 2 | 23.69 | 20-Apr | 4 | 22-Apr | 14-May | 3 | 3 | Chicks foraged on soundside |
| 3 | 3 | 23.61 | 20-Apr | 4 | 22-Apr | N/A | 0 | 0 | Nest abandoned by 5/24 |
| 4 | 4 | 24.16 | 20-Apr | 4 | 22-Apr | 17-May | 4 | 0 | Brood failed by 6/6, cause unknown. |
| 5 | 5 | 23.59 | 25-Apr | 4 | 27-Apr | N/A | 0 | 0 | Nest lost to weather/ flooding |
| 6 | 6 | 23.65 | 27-Apr | 4 | none | N/A | 0 | 0 | Unknown loss, nested in 2014 treated phragmites. |
| 7 | 7 | 23.87 | 4-May | 4 | 6-May | N/A | 0 | 0 | Abandoned by 5/26, sanded over. |
| 8 | 5 | 23.6 | 18-May | 4 | 22-May | 17-Jun | 4 | 0 | Brood failed 7/3, cause unknown. |
| 9 | 8 | 23.56 | 24-May | 4 | 31-May | 21-Jun | 4 | 0 | Brood failed 7/4, cause unknown. |
| 10 | 9 | 47.19 | 29-May | 3 | 1-Jun | N/A | 0 | 0 | Nest failed by 6/4, cause unknown |
| 11 | 7 | 23.87 | 29-May | 3 | none | N/A | 0 | 0 | Brood failed 5/26, cause unknown. |

9 nesting pairs, 11 nests, 5 hatched nests, 3 chicks fledged

Appendix 3. Chart 1 Piping Plover Nesting and Chart 2 Piping Plover Productivity.

Chart 1. Piping Plover Nesting at Cape Lookout National Seashore

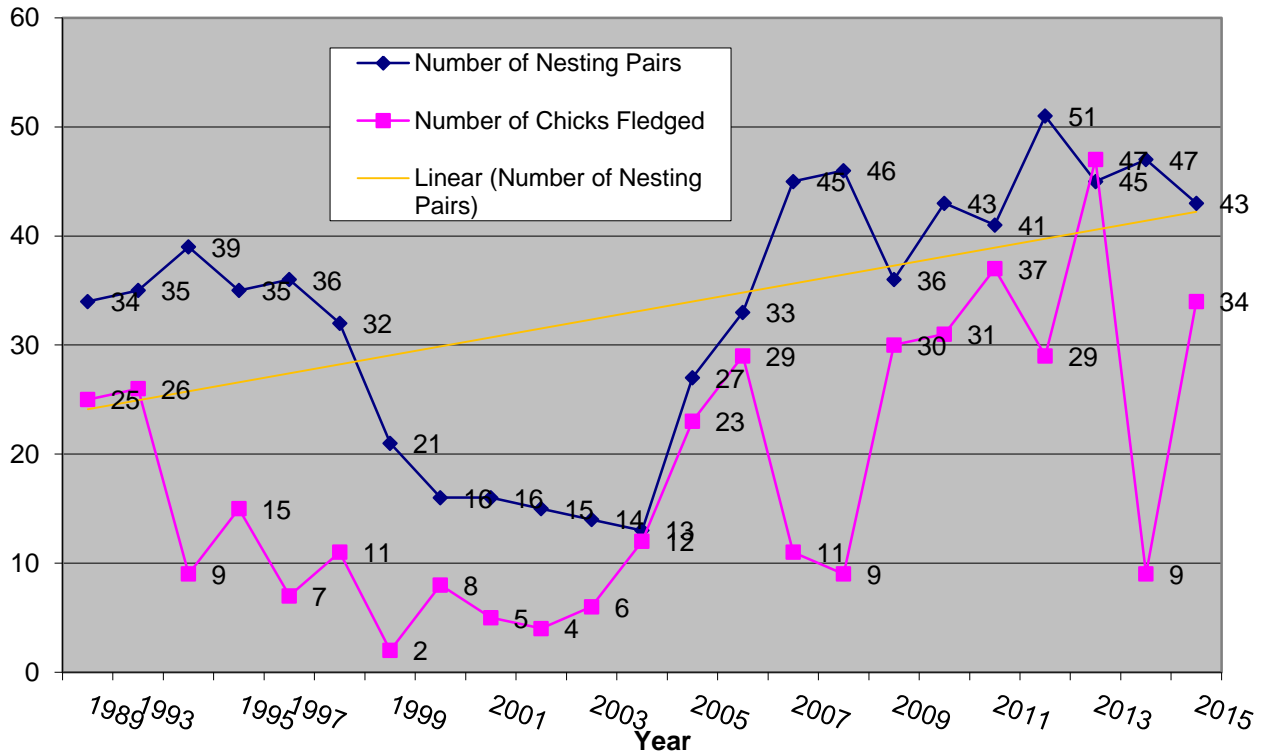
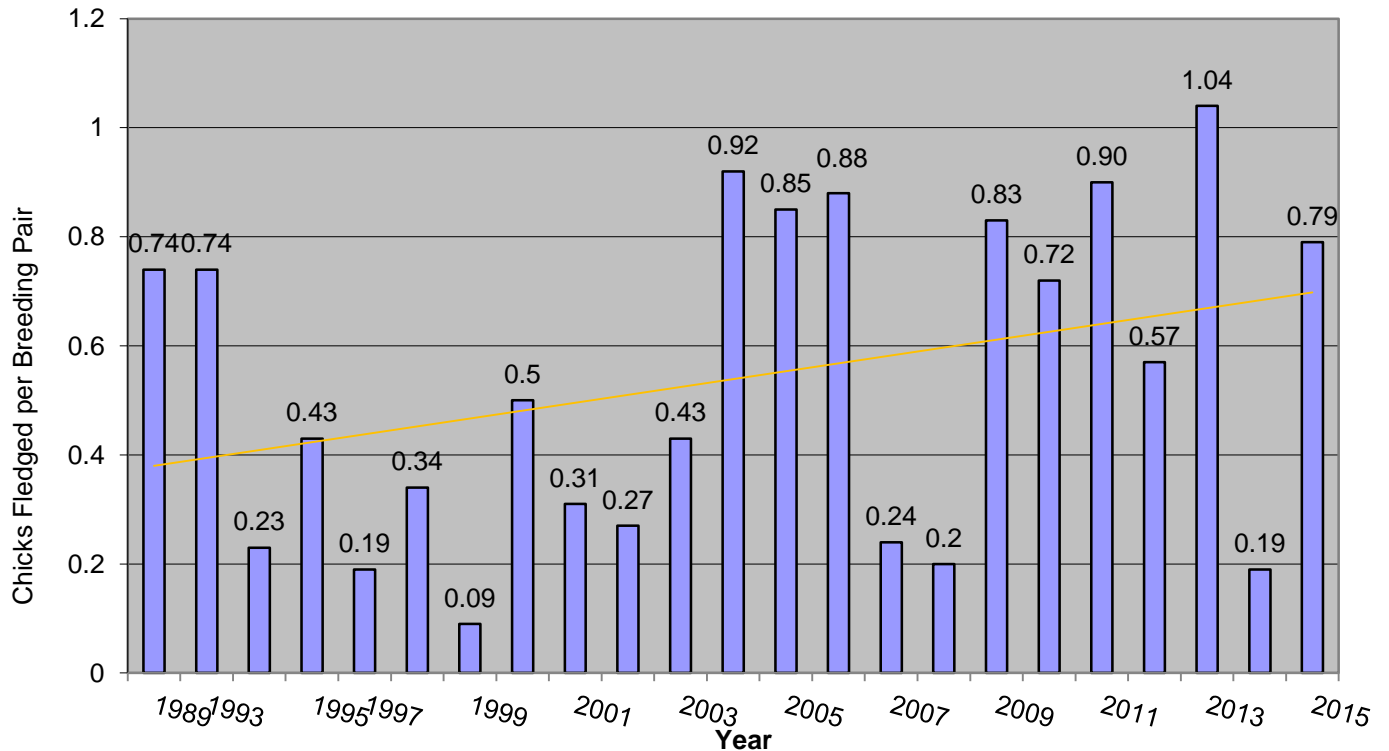


Chart 2. Piping Plover Productivity with Simple Linear Regression Line at CALO



Appendix 4. Monthly counts of non-nesting piping plovers 2009-2015.

| Date | North Core Banks | South Core Banks | Shackleford Banks | CALO Total |
|--------------|------------------|------------------|-------------------|------------|
| January-09 | 6 | 18 | 13 | 37 |
| February-09 | 2 | 9 | 12 | 23 |
| March-09 | 10 | 17 | ? | ≥27 |
| August-09 | 83 | 26 | 2 | 111 |
| September-09 | 144 | 33 | 10 | 187 |
| October-09 | 22 | 19 | 13 | 54 |
| November-09 | 18 | 12 | 12 | 42 |
| December-09 | 12 | 14 | 23 | 49 |
| January-10 | 17 | 8 | 11 | 36 |
| February-10 | 8 | 5 | 11 | 24 |
| March-10 | | 10 | 6 | ≥16 |
| August-10 | 125 | 23 | 4 | 152 |
| September-10 | 70 | 32 | 17 | 119 |
| October-10 | 35 | 13 | 4 | 52 |
| November-10 | 8 | 19 | 9 | 36 |
| December-10 | 4 | 3 | 6 | 13 |
| January-11 | 6 | 2 | 7 | 15 |
| February-11 | 7 | 0 | 8 | 15 |
| March-11 | 12 | 8 | 13 | 33 |
| August-11 | 81 | 26 | 0 | 107 |
| September-11 | 29 | 8 | 20 | 57 |
| October-11 | 26 | 19 | 6 | 51 |
| November-11 | 7 | 3 | 11 | 21 |
| December-11 | 2 | 4 | 11 | 17 |
| January-12 | 0 | 2 | 5 | 7 |
| February-12 | 0 | 2 | 10 | 12 |
| March-12 | 5 | 1 | ? | ≥6 |
| August-12 | 82 | 32 | 4 | 118 |
| September-12 | 112 | 7 | 9 | 128 |
| October-12 | 0 | 3 | 12 | 15 |
| November-12 | 3 | 7 | 5 | 15 |
| December-12 | 6 | 6 | 2 | 14 |
| January-13 | ? | 4 | 3 | 7 |
| February-13 | 4 | 0 | 10 | 14 |
| March-13 | 5 | 9 | 4 | 18 |
| August-13 | 93 | 6 | 15 | 114 |
| September-13 | 115 | 15 | 23 | 153 |
| October-13 | 17 | ? | ? | ≥17 |
| November-13 | 6 | 5 | 5 | 16 |
| December-13 | 12 | 3 | 4 | 19 |
| January-14 | 0 | 12 | 0 | 12 |
| February-14 | 0 | 0 | 9 | 9 |
| March-14 | 7 | 42 | 4 | 53 |
| August-14 | 98 | 44 | 9 | 151 |
| September-14 | 69 | 12 | 1 | 82 |
| October-14 | 12 | 12 | 0 | 24 |
| November-14 | 13 | 6 | 4 | 23 |
| December-14 | 4* | 14 | 3 | 21 |
| January-15 | 2 | 9 | 4 | 15 |
| February-15 | | | | |
| March-15 | ? | 21 | 19 | 40 |
| August-15 | 95 | 15 | 15 | 125 |
| September-15 | 42 | 20 | 8 | 70 |
| October-15 | 17 | 3 | 14 | 34 |
| November-15 | 0 | 4 | 8 | 12 |
| December-15 | 5 | 18 | 2 | 25 |

Appendix 5. Non-Breeding Banded Piping Plover Observations at CALO in 2015

| Initial Date | Upper Left Leg | Lower Left Leg | Upper Right Leg | Lower Right Leg | Island | Comments: population, state, park code, (other re-sight dates at CALO) |
|--------------|------------------|--------------------|-----------------|-----------------|--------|--|
| 1/16/2015 | metal | red | orange flag | blue blue | SCB | Great Lakes, MI and SLBD |
| 1/16/2015 | metal | green/orange/green | orange | none | SCB | Great Lakes, APIS (9/25/2014-4/25/2015 and 12/15/2015) |
| 4/5/2015 | metal | none | white flag (EU) | none | NCB | NB, Canada and Bahamas |
| 5/1/2015 | none | white | none | yellow black | NCB | Bahama, CALO (Breeder 2012-2015) |
| 7/13/2015 | yellow green | none | green yellow | none | NCB | ASIS, MD 2010 |
| 8/4/2015 | Gf (YOP) | none | orange | none | MCB | FIRE, NY 2014 (8/15) |
| 8/5/2015 | Gf (OCX) | none | orange | none | MCB | CAHA, NC 2015 |
| 8/5/2015 | metal | orange orange | Yf (009) | black yellow | MCB | North Dakota 2015 (8/5-9/5) |
| 8/5/2015 | Gf (JPX) | none | orange | none | MCB | CAHA, NC 2015 |
| 8/5/2015 | Gf (YX6) | none | orange | none | MCB | CAHA, NC 2015 |
| 8/5/2015 | metal | blue/orange | none | none | MCB | Great Lakes Wasaga Beach, ON, Canada |
| 8/6/2015 | orange | none | Gf (C15) | none | SCB | CALO, NC 2015 |
| 8/7/2015 | metal | none | Pf (26) | none | MCB | Bahamas 2015 |
| 8/7/2015 | green light blue | none | red blue | none | MCB | NJ (8/7 & 9/17) |
| 8/7/2015 | metal | none | Bf (LL) | none | MCB | Magdalen Islands, Canada 2014 |
| 8/7/2015 | blue | none | orange | none | MCB | MA 2013, CALO 2014, Bahamas |
| 8/14/2015 | green | none | Gf (LAL) | none | SB | New Jersey, 2015 |
| 8/15/2015 | metal | none | Bf (C6) | none | MCB | NB, Canada 2015 (9/17) |
| 8/15/2015 | Gf (J39) | none | orange | none | MCB | CAHA, NC 2015 |
| 8/15/2015 | Bf (LO) | none | none | metal | NCB | Quebec, Canada (8/24) |
| 8/15/2015 | Gf (KKK) | none | blue | none | NCB | RI, 2015 |
| 8/15/2015 | metal | none | Bf (41) | none | NCB | NL, Canada (8/24-10/30) |
| 8/15/2015 | Gf (8C5) | none | orange | none | NCB | CALO, NC 2015 (8/24) |
| 8/18/2015 | orange | none | metal | light blue | MCB | Great Lakes, MI SLBD |
| 8/24/2015 | metal | none | Bf (CA) | none | NCB | NB, Canada 2015 |
| 9/5/2015 | Gf (2MU) | none | blue | none | MCB | MA, 2015 (9/17) |
| 9/5/2015 | Gf (5MP) | none | orange | none | MCB | CALO, NC 2015 |
| 9/15/2015 | Gf (6XA) | none | orange | none | NCB | CALO, NC 2015 (9/18) |
| 9/15/2015 | metal | red | orange flag | black | MCB | Great Lakes |
| 9/15/2015 | green white | none | orange yellow | none | NCB | New Jersey 2015 |
| 10/16/2015 | orange | none | Gf (HOJ) | none | SCB | FIRE, NY 2015 |
| 11/20/2015 | metal | orange green | Yf (V90) | white green | SCB | North Dakota (11/6-12/15) |
| 11/24/2015 | none | orange | metal | light blue | SB | SLBD, MI |
| 12/15/2015 | metal | orange | orange flag | black orange | SCB | Great Lakes, MI 2012 |

Figure 1. Map of 2015 Occupied Piping Plover Nesting Sites at Cape Lookout National Seashore.

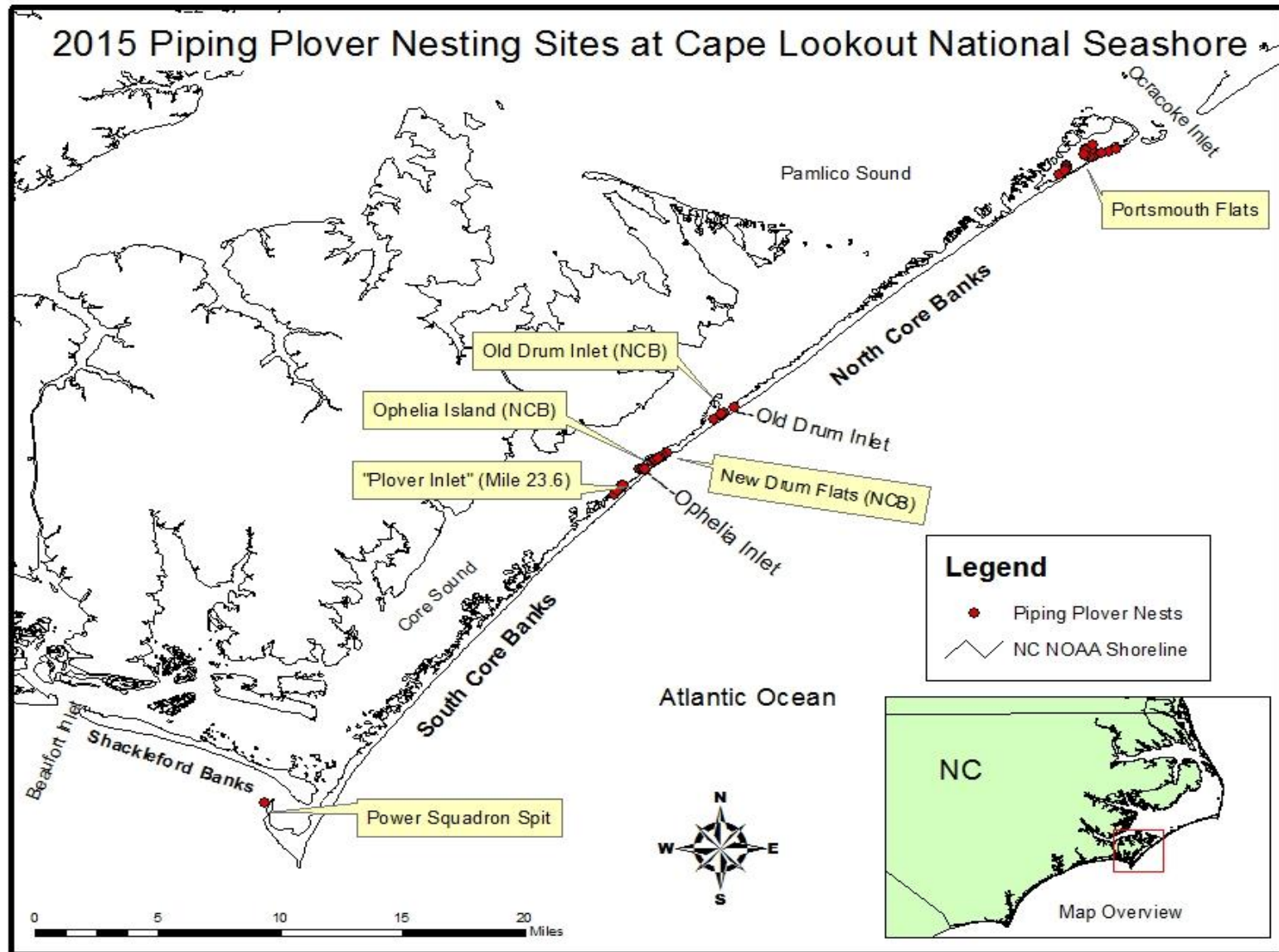
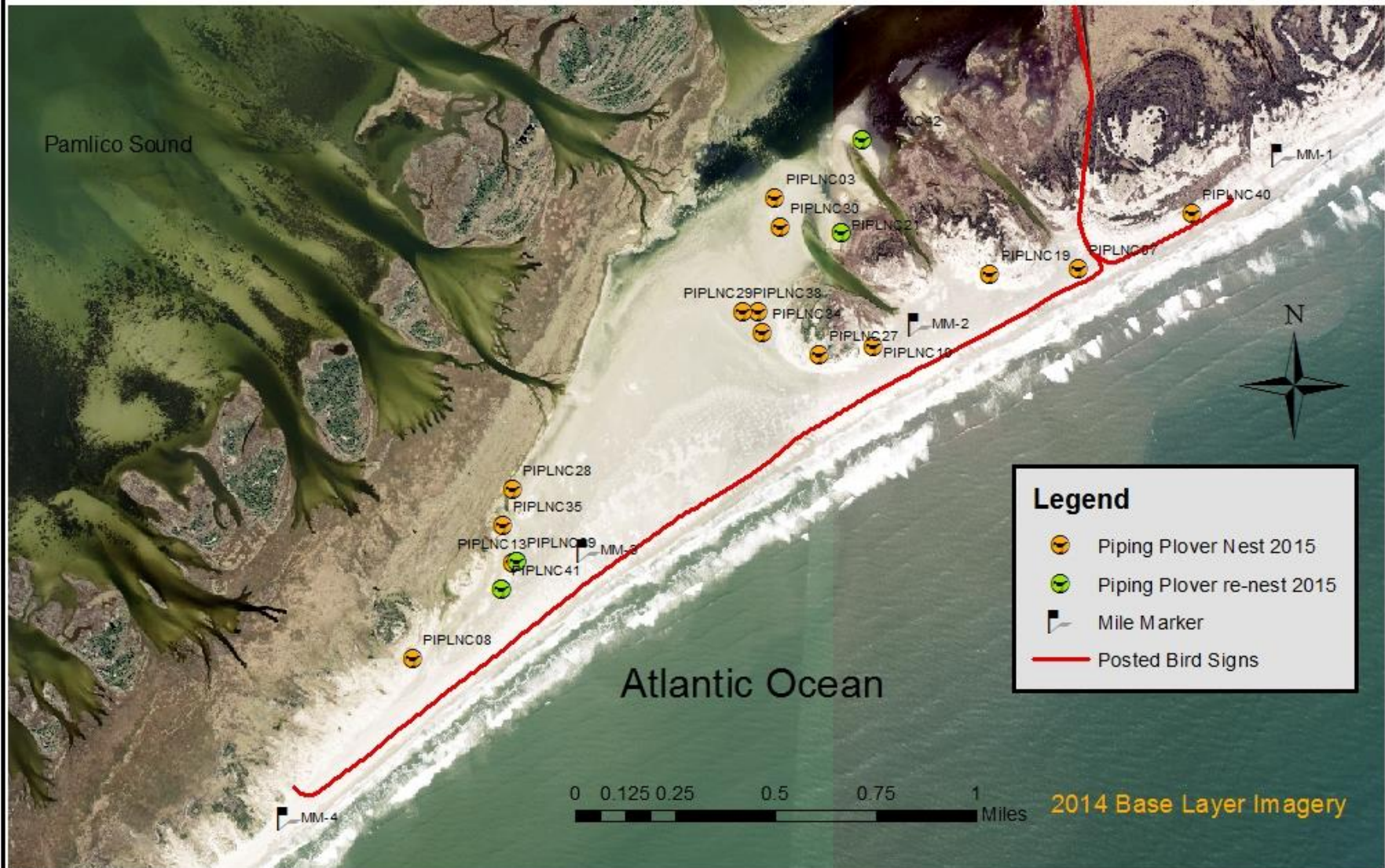




Figure 2. Portsmouth Flats Nesting Site



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December 2015

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Figure 3. Old Drum Inlet Nesting Site

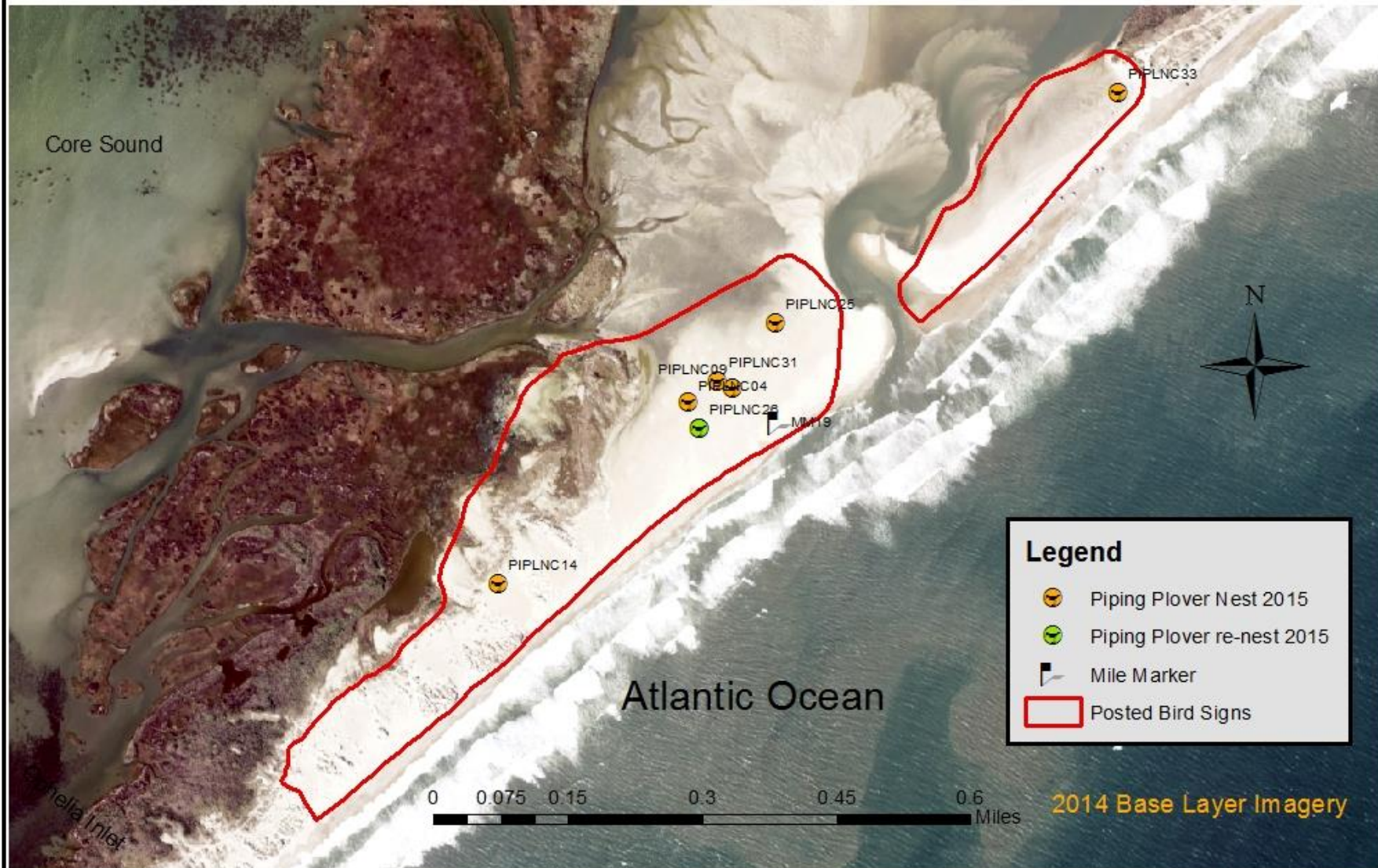
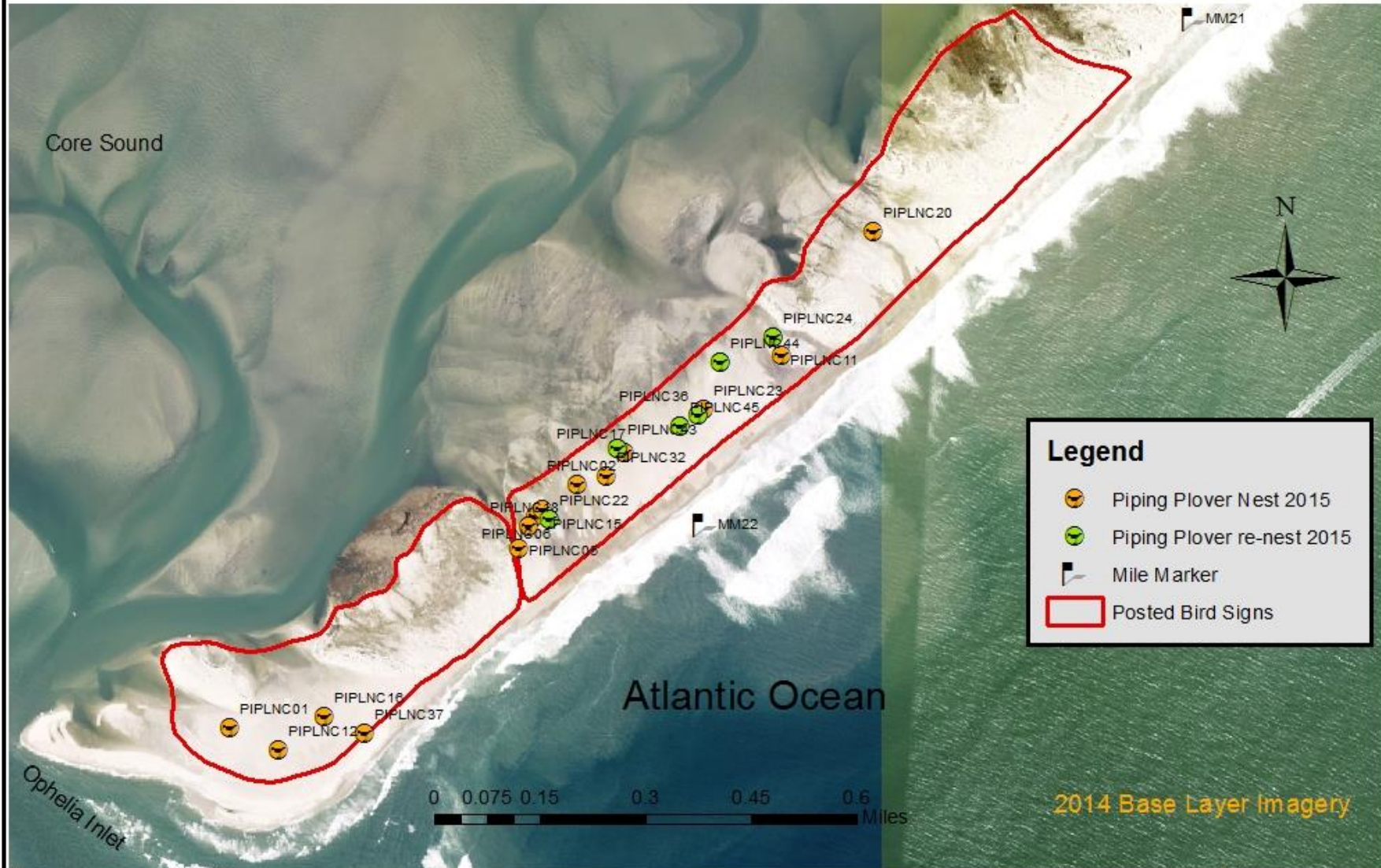




Figure 4. New Drum Flats and Ophelia Island Nesting Sites



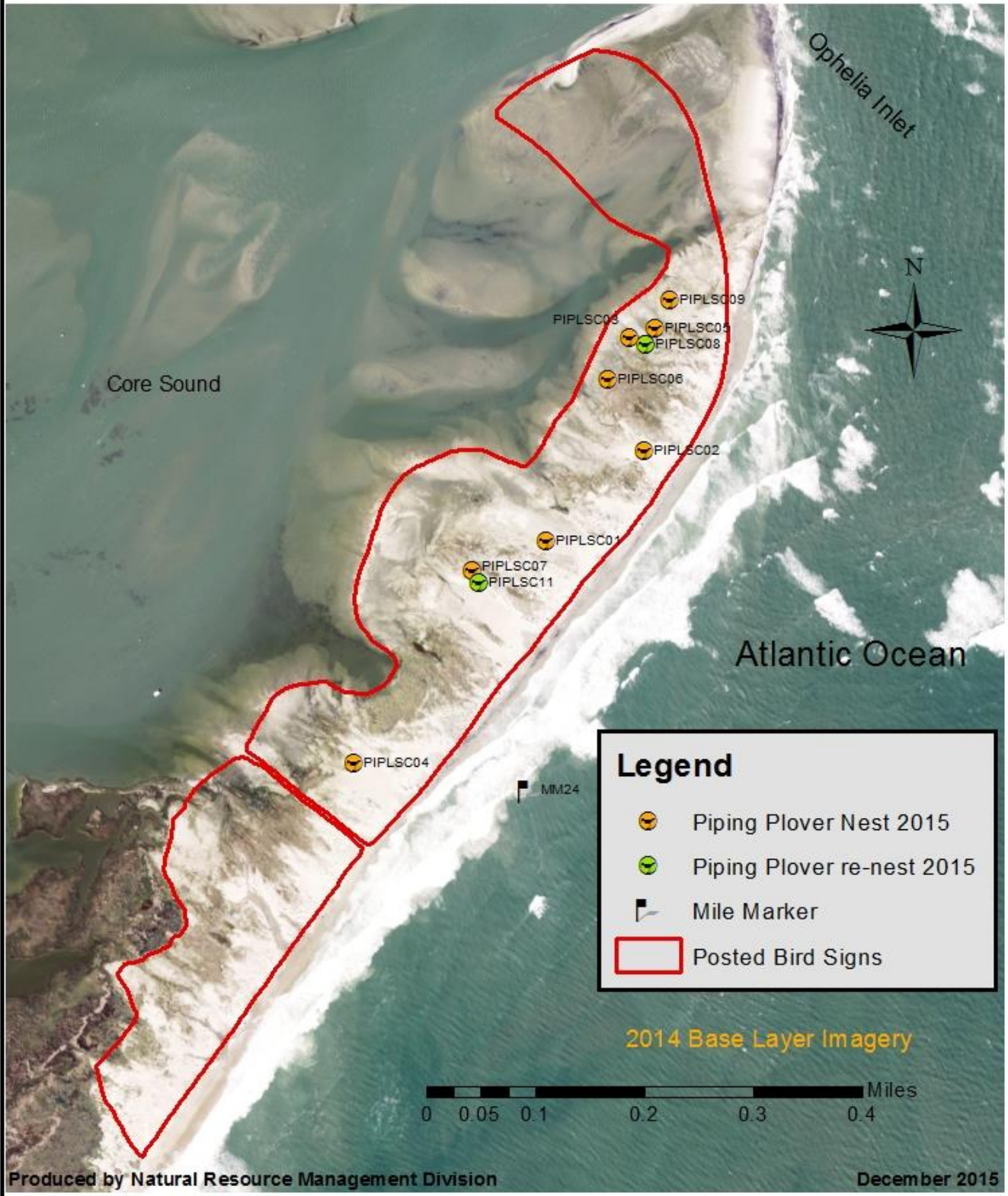
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Figure 5. Plover Inlet Nesting Site



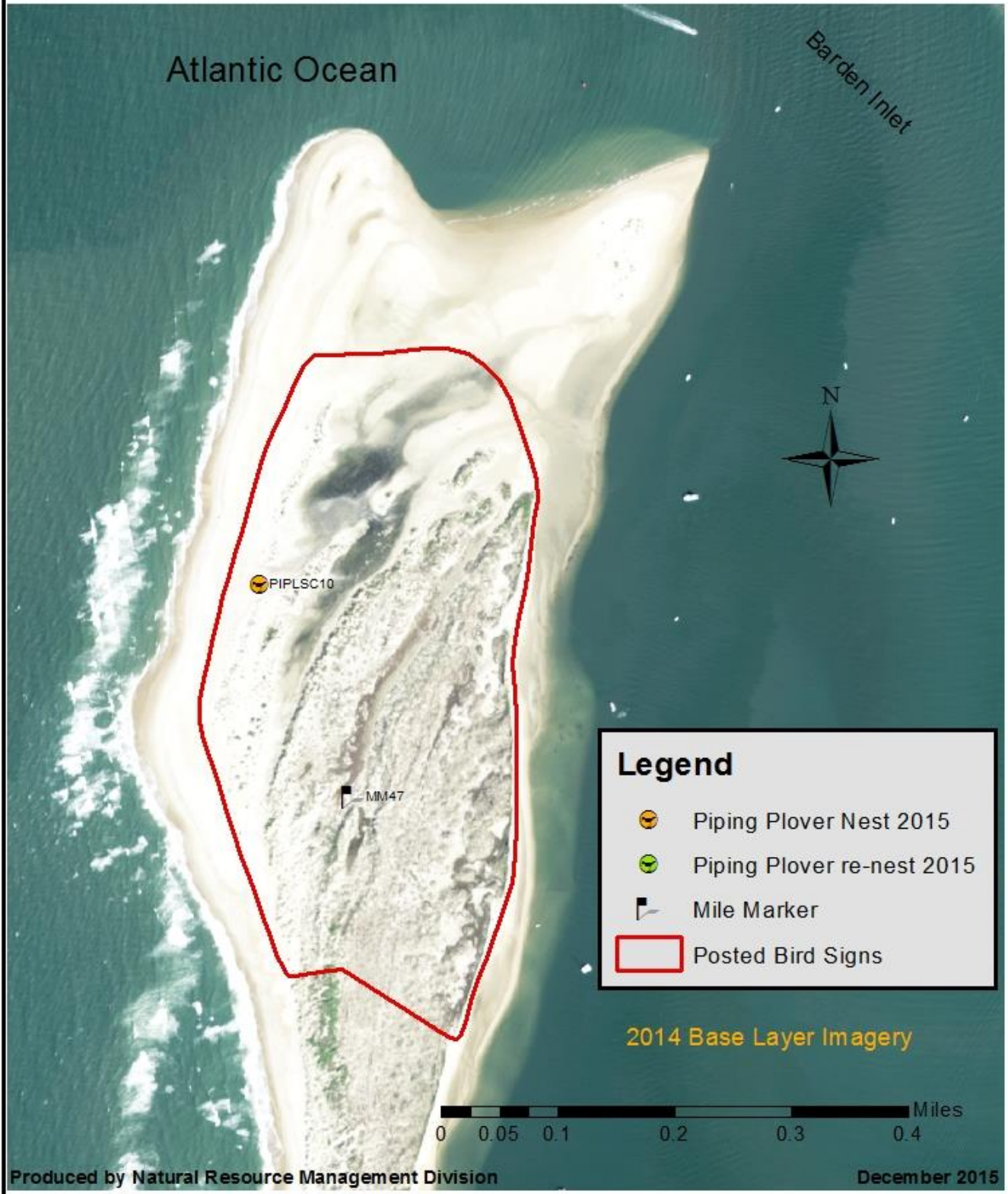
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Figure 6. Power Squadron Spit Nesting Site



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Figure 7. Map of Non-Breeding Observations, Critical Winter Habitat Units and banded bird re-sights.

